

Department of Civil and Environmental Engineering

Overview

This past year has been one of transition, progress, and success for the Department of Civil and Environmental Engineering (CEE). Our Strategic Plan, developed over academic year 2004, has been further refined and completed, incorporating comments and recommendations from the Visiting Committee report (2005).

“Engineering and science for the provision of human services in a sustainable way” captures both the vision and aspirations of the department. We are very optimistic about the future of civil and environmental engineering in general and our department’s unique role therein. Working toward the implementation of this vision, we have developed a new undergraduate curriculum that better integrates the human infrastructure and natural environment portions of our disciplines. More information about our new undergraduate program is detailed below under educational activities.

As we make progress toward the goals outlined in our Strategic Plan, we have also been successful with current faculty promotions and recent hiring. Professors Martin Polz and Charles Harvey were both awarded tenure, and Professor Heidi Nepf was promoted to the rank of full professor.

Dr. Roman Stocker—following our 2004 offer and after finishing his two years as an instructor in applied mathematics in MIT’s Department of Mathematics—will join the CEE faculty as an assistant professor effective July 1, 2005. He received his PhD in civil and environmental engineering from the University of Padova in 2003. An environmental fluid mechanician, Professor Stocker is interested in microbiological fluid flow research.

We are also pleased to report on our most recent (spring 2005) and successful faculty hiring season. Drs. Eric Alm, Markus Buehler, and Janelle Thompson have accepted our offer to join the department as assistant professors, effective January 2006, July 2006, and July 2007, respectively.

Eric Alm received his PhD in biochemistry from the University of Washington in 2001 and is currently a scientist at the Lawrence Berkeley National Laboratory. His research interests cover structural and biophysical chemistry combined with computational microbial biology and genomics. He will assume a dual position in the department and the Biological Engineering Division.

Markus Buehler received his PhD (Dr. rer. nat.) from the Max Planck Institute in Stuttgart in 2004 and has a postdoctoral position at California Institute of Technology. His research interests include mechanical properties of solids, multiscale modeling of dynamic materials phenomena, and interfaces of physics, chemistry, and biology, with an emphasis on molecular dynamics tools. Markus will arrive as early as September 2005, when he will assume first a postdoctoral position in CEE until June 2006.

Janelle Thompson received her PhD in biological oceanography from the MIT/WHOI Joint Program in 2005. Her research interests include using tools of molecular biology to identify the components of microbial communities and the dynamics and organization of those components, which will eventually reveal system properties via a “reverse engineering” approach. Janelle will first join Harvard for a two-year postdoctoral position before taking her MIT faculty position.

Initiatives

As explained above and detailed further in the report, a major program initiative this year has been the restructuring of the undergraduate curriculum. In order to support the objectives of this curriculum, we are also renovating space in the basement of Building 1, and a new undergraduate teaching laboratory facility will be provided for academic year 2006.

Key existing faculty-driven research includes environmental genomics, water contamination (e.g., arsenic), remote sensing, data fusion, logistics/intelligent transportation, and durability mechanics, to name a few. With recent faculty hires, we have also consolidated our collaboration with the Biological Engineering Division and have now a world-class, unparalleled Microbial Systems Group within the department.

The department also continues to actively help with the development of the Earth System Initiative (<http://web.mit.edu/esi/>) and its affiliated Terrascope program for MIT freshmen (<http://web.mit.edu/terrascope/www/>).

Research directions for the department include fundamental advances associated with the multiphase (micro to macro) nature of our fields and the successful incorporation of life cycle and sustainability concepts in a systematic fashion. Critical specific areas of investment will include the following:

- Analysis, design, control, and sustainability of complex man-made systems (“critical infrastructure”)
- Theoretical and experimental research on environmental systems (air pollution, aquatic and soil chemistry, microbial systems)
- Innovative materials and their engineering uses (mechanical properties of [geo] materials and their coupling with chemical and biological processes)
- Energy and environment

On the marketing and visibility front, our new web site was launched in October, followed by an advertising campaign promoting our new undergraduate curriculum. We continue to advertise our academic programs, and a marketing plan to increase publicity for our graduate programs is underway.

Educational Activities

Student Enrollment over the Past Five Years

	AY 2001 (Fall 2000)	AY 2002 (Fall 2001)	AY 2003 (Fall 2002)	AY 2004 (Fall 2003)	AY 2005 (Fall 2004)
Total Undergraduates	69	62	77	80	75
MEng	66	38	61	33	24
MST	40	46	44	40	43
SM	112	119	116	95	61
PhD	71	71	68	71	74
Total Graduates	289	274	289	239	202

Undergraduate Program

At MIT, the identity of an engineering department is closely related to both research and undergraduate education. The undergraduate curriculum is a tangible way to define priorities and to establish a vision for the future. In the last year we have finalized and obtained approval for a new undergraduate program that takes a progressive approach to engineering education and provides the vision and leadership for our profession.

In our undergraduate program, we focus on ways to use science, engineering, and policy to improve the quality of life in an environmentally compatible way. This includes intelligent use of valuable natural resources such as the energy, raw materials, and ecosystems needed to sustain modern society. It also includes the development of functional and sustainable facilities. These themes form the basis for our new undergraduate curriculum. The CEE curriculum provides an excellent foundation for careers as diverse as engineering design, education, law, and public health. We expect our graduates to teach and carry out research in universities, work for large firms, start their own businesses, and take positions in government and nonprofit organizations.

The department's educational program provides background in science and engineering fundamentals while also emphasizing hands-on design projects and case studies that provide context and motivation. Students are taught how to combine theory, measurement, and modeling to develop a good understanding of the problem at hand and to point the way to desirable solutions.

The department offers three undergraduate tracks: 1A Civil and Environmental Engineering, 1C Civil Engineering, and 1E Environmental Engineering Science. Beginning in fall 2005, sophomores in all three tracks will take a common core of classes in ecology, mechanics, mathematics, and engineering design (a new Institute laboratory). Juniors and seniors are able to specialize in any of the three tracks in order to qualify for professional accreditation or to prepare for specialized postgraduate study. Upper-class subjects have been reorganized in order to build on the common sophomore core.

In addition to the new curriculum, undergraduates in CEE continue to take advantage of our internship program, study tours in foreign countries, participation in an exchange program with Cambridge University, and UROP (research) opportunities. This fall will be the fourth year that freshmen are invited to take part in “Discover Civil and Environmental Engineering” (DCEE), our annual pre-orientation introduction to the department. DCEE is part of MIT’s Freshman Pre-Orientation Programs. Between field trips to see civil and environmental engineering “in action” around Boston, DCEE participants work with student mentors and compete to design an engineering structure to a set of design constraints. These projects are then tested and judged by a panel of faculty members. With all of our programs, we are continuing to make progress on our goal of doubling the number of undergraduates enrolled in Course 1 within the next two years.

Graduate Program

Master of Engineering, Master of Science, and Doctor of Philosophy Programs

Our graduate students are engaged in cutting-edge research in a variety of disciplines. This year saw a large number of PhD graduates (27), with many going on to positions in academia across the world. While many students in our Master of Science (SM) programs go on to doctoral studies and then to careers in academia, the majority of students in two of our programs (the Master of Engineering [MEng] and Master of Science in Transportation [SMT]) move on to jobs in industry and government after completing their degrees.

We have recently launched a review of the Master of Science in Transportation program and are currently engaged in determining the appropriate role for this robust degree program within our department. The review committee is investigating key elements related to the program, including its interdepartmental status and its relationship to the Center for Transportation and Logistics. Interviews with current faculty, adjunct faculty, and students as well as an in-depth alumni survey have taken place, and recommendations on the format and requirements of the program in the future are forthcoming.

We are pleased to announce that the first students have enrolled in a new departmental doctoral program—the CEE/Systems PhD. This program focuses on the intersection of information technology, modeling and analysis, and CEE applications. It requires students to conduct scholarly research by applying computational, operations research and statistical methods to CEE applications such as infrastructure, transportation, logistics, environment, energy, and security.

This June saw the graduation of the 10th class of MEng degree program students. We are marking the occasion with an MEng alumni reunion, planned for October 2005. Overall, the students in this program continue to be excellent; the average cumulative GPA for students in the class of 2005 was 4.72. Enrollment is climbing: 31 students will begin the program this fall. In an effort to nurture the relationship between our MEng students and prospective employers and to increase the visibility of the program, we have launched a new campaign to increase fellowship support for MEng students. We

are pleased to recognize Gradient Corporation as the first company to lend its support to this program, and we are looking forward to greeting additional firms whose support is forthcoming.

Faculty Notes

Professor Rafael Bras was named the Edward A. Abdun-Nurs professor. Additionally, he was awarded corresponding membership in the National Academy of Engineering in Mexico. Professor Bras also completed his two-year term as chair of the MIT Faculty.

Professor Penny Chisholm was inducted into the National Academy of Sciences.

Professor Jerome J. Connor received MIT's 2005 Frank E. Perkins Award for exceptional service as a graduate advisor and mentor. Additionally, he was appointed a foreign associate of the British *Journal of Engineering for Sustainability* sponsored by the Institute of Civil Engineers.

Professors Penny Chisholm and Edward DeLong are among the four Moore Foundation Investigators in Marine Science selected nationally. Each investigator will receive almost \$5.5 million over the next five years.

Professor Edward DeLong was elected a fellow of the American Academy of Arts and Sciences. He was also awarded the Joseph Martore Award for Outstanding Contributions to Education.

Professor Herbert Einstein was appointed an honorary member of the Boston Section of the American Society of Civil Engineers.

Professor Dara Entekhabi was named the Bacardi Stockholm Water Foundations professor. He was also elected senior member of the Institute of Electrical and Electronics Engineers.

Professor Charles Harvey was awarded tenure.

Professor Richard Larson was named the Mitsui professor. He also received the Harold Larnder Prize in Operations Research in Canada.

Professor Ole Madsen was named the Donald and Martha Harleman professor. He was also appointed acting director of the Ralph M. Parsons Lab for AY2005.

Professor Chiang Mei was named the Ford professor of engineering.

Professor Heidi Nepf was promoted to full professor. She is also serving on the Institute Task Force to reexamine the undergraduate General Institute Requirements.

Professor Martin Polz was awarded tenure.

Professor David Simchi-Levi published the second edition of *The Logic of Logistics: Theory, Algorithms and Applications for Logistics and Supply Chain Management*. He also published the *Handbook of Quantitative Supply Chain Analysis: Modeling in the c-Business Era*. He was named codirector of the Leaders for Manufacturing (LFM) and Systems, Design, and Management (SDM) degree programs.

Professor Joseph Sussman's new book entitled *Perspectives on Intelligent Transportation System (ITS)* was published by Springer in April 2005.

Professor Franz-Josef Ulm received this year's Huber Prize from the American Society of Civil Engineering for notable achievements in research related to civil engineering.

Student Notes

Among the winners of the William Stewart Jr. Awards at the MIT Awards Convocation were William Fowler '05 and graduate students Khandaker Ashfaque (Graduate Student Council) and Emily Slaby (Student Advisory Group to the Corporation Committee on the Presidency).

Patrick Hart '06 is in Theta Chi, which received the D. Reid Weedon Jr. '41 Alumni/ae Relations Award.

Alia Burton '05 was one of two winners of the Albert G. Hill Prize, given to minority juniors or seniors with high academic standards and continued contributions to improving the quality of life for minorities at MIT.

For her outstanding academic performance, Maria Schriver '05 was elected to the MIT chapter of Phi Beta Kappa.

Graduate student Janine Waliszewski was awarded a Fulbright fellowship. She will spend the award year studying transit issues in Sao Paulo, Brazil.

MEng students Pragnya Alekal, Xanat Flores, and Brian Robinson, as well as graduate students Matthew Orosz (MEng '03) and Amy Mueller, were members of winning teams in this year's IDEAS Competition.

Vladimir Barzov '07 placed in the top five in the annual William Lowell Putnam Mathematics Competition, the most prestigious national math exam for undergraduates. Graduate student Abe Menzin has won a National Defense Science and Engineering Graduate (NDSEG) fellowship for AY2006.

Hai Ning '04 (PhD) of the Intelligent Engineering Systems Lab won the Best PhD Student Presentation Award in the Seventh International Conference on Computers and Advanced Technology in Education in Kauai, Hawaii, in August 2004.

Doctoral student Charisma Choudhury was selected as a 2004–2005 Martin fellow. The Martin Family Society of Graduate Fellows in Sustainability provides fellowships in the areas of environment and sustainability.

Cecily Way '05 was awarded a Public Service fellowship from MIT's Public Service Center.

Farah Ghniem '07 took third prize in the short story division of the Robert A. Boit Writing Prize.

Chi Epsilon, the national civil engineering fraternity, welcomed its new inductees in April. The new members from CEE were Alison Baker '05, Alia Burton '05, Abraham Reyer '05, Andrea Silverman '05, Laura Stonehill '06, James Vanzo '06, Elizabeth Walker '06, and Cecily Way '05.

Departmental Awards

The Department of Civil and Environmental Engineering held its Annual Awards Dinner on May 13, 2005. Many students, faculty, and staff were honored for their achievements and accomplishments over this past academic year.

The Maseeh Excellence in Teaching Award was presented to Professor Steven Lerman for his outstanding teaching in 1.00 and 1.001 Introduction to Computers and Engineering Problem Solving.

The Maseeh Annual Award for Excellence as a Teaching Assistant went to graduate student Todd Radford for his outstanding work in 1.561 Motion-Based Design, 1.562 High Performance Structures Project, and 1.571 Structural Analysis and Control.

The 2005 Tucker-Voss Award went to Choong Ryun Oh, a graduate student in construction management. Steven Alpert '05 won the Leo '24 and Mary Grossman Award in recognition of high scholastic standing and a strong interest in transportation. Katherine Lin '05 won the Richard Lee Russel Award for an outstanding undergraduate in CEE who plans to continue with graduate study. The Steinberg Prize, recognizing an undergraduate student for academic achievement and demonstrable interest in construction management, was won by Alison Baker '05. A new award was given for the first time this year: Charuleka Varadharajan won the Trond Kaalstad Award for an outstanding graduate student who has displayed leadership and/or contributed significantly to the well-being of the CEE community.

The student outreach coordinator for the American Society of Civil Engineers presented an award to Lynn Ngo for her efforts with the Civil and Environmental Engineering Student Association.

The following staff received Special Service Awards, conferred in recognition of outstanding service to the department in AY2005: Victoria Murphy, financial administrator; Sara Goplin, communications officer; Maria Mariangelo, administrative assistant to Professor Cindy Barnhart; Anthee Travers, administrative assistant to department head, Professor Patrick Jaillet.

Special congratulations are in order for Stephen Rudolph, designer and CAD operator, who received an Infinite Mile Award at the May 4 School of Engineering Awards Ceremony.

Patrick Jaillet

Department Head

Edmund K. Turner Professor of Civil and Environmental Engineering

More information about the Department of Civil and Environmental Engineering can be found online at <http://cee.mit.edu/>.